MULTIMEDIA UNIVERSITY®

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

ECP1026 – ALGORITHM AND DATA STRUCTURE

(TE/RE)

8 MARCH 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of 6 pages including cover page with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) In your own words define:

i. Array

ii. Record/structure

[2 marks]

(b) Given the following data

Table 1.1 Data

Flavour	Price per unit (RM)	Unit sold	Unit available
Vanilla	3.50	10	35
Chocolate	3.50	23	22
Matcha	3.80	17	28
Summer berries	4.00	24	21

Write a program to:

- Store the data in array of record
- Print the data in tabular form using `for` loop

[8 marks]

(c) A palindrome is a string that can read backward and forward with the same result. For example

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Write a program to test is a string is a palindrome using a stack. Your program should:

- Receive an input string from user
- Push the characters of the input string one by one into the stack
  - Covert any upper case character to lower case before pushing the character into stack
- Once the end of the input string is reached, pop the character one by one to form a new string.
- Compare the input string with the new string

(HINT: `string.h`)

[15 marks]

Continued...

Question 2

a) Real numbers can be presented in different ways. Two methods to represent real numbers are fixed point and floating point representation. Fill up Table 2.1 with the strength and weakness of both methods according to each aspect.

Table 2.1 Fixed point vs floating point representation of real numbers

	Fixed point	Floating point
Range of numbers		
Speed		
Ease of programming		

[3 marks]

b) The graph in Figure 2.1 shows the distance between 4 places; A, B, C and D.

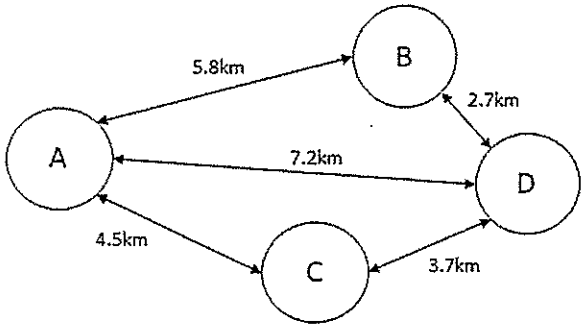

Figure 2.1 Graph

```
#include <stdio.h>

#define NPLACE 4
#define NOP -1

char places[4]={'A', 'B', 'C', 'D'};

float roads[NPLACE][NPLACE]= {{0,5.8,4.5,7.2},
{5.8,0,NOP,2.7}, {4.5, NOP,0,3.7}, {7.2,2.7,3.7,0}};

void traverse (int v, int *visited);

int main(){
    int visited[NPLACE]={0};
    float dist = 0;
    bool ret;
    traverse(0, visited);
    return 0;
}
```

Figure 2.2 Graph traversal program

Continued...

i. Write the definition of `traverse` function in Figure 2.2 so that the graph is traversed using preorder traversal.
(NOTE: NOP is used to represent no direct path between two places)
[6 marks]

ii. Modify the `traverse` function so that the total distance among the places visited are calculated.
[6 marks]

iii. Write the expected output of the program in Figure 2.2 using the modified `traverse` function (Question 2(b)(ii)).
[2 marks]

c) What is a binary tree?
[2 marks]

d) Traverse the tree shown in Figure 2.3 using: preorder, postorder and inorder traversal.

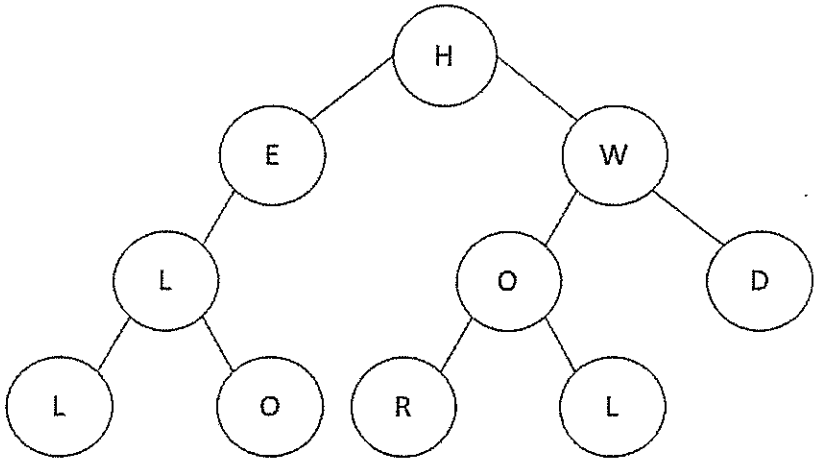

Figure 2.3 Binary Tree

[6 marks]

Continued...

Question 3

(a) The Fibonacci sequence can be defined mathematically as follows:

$F_0=0$, $F_1=1$, $F_n=F_{n-1}+F_{n-2}$ where n=2,3,4,....

Each Fibonacci number is the sum of the two preceding numbers.

(i) Write the Fibonacci sequence if n is given as 7.

[2 marks]

(ii) Implement the mathematical formulae to calculate Fibonacci value, F_n, for the given number, n, in ANSI-C using a direct recursive function. The function prototype is given as:

```
int Fibonacci(int n);
```

[6 marks]

(c) Explain the difference between direct recursion and mutual recursion.

[2 marks]

(c) Consider the function definitions given in Figure Q3.1.

```
1   int f1(float a[], int n){
2     int k, c=0;
3     float sum=0;
4
5     for(k=0; k<n; k++){
6       if(a[k]>=50){
7         c++;
8       sum = sum + a[k];
9     }
10    printf("Average = %.2f\n", sum/n);
11    return c;
12  }
13
14  int f2(int n){
15
16    if(n==0){
17      return 0;
18    else
19      return 2+f2(n-1);
20  }
```

Figure Q3.1

(i) Indicate clearly the time complexity of each statement, if any.

[12 marks]

(ii) For function f2, the probability of getting a value of a[k] that is greater than or equal to 50 is given by 0.65, determine its average-case time complexity.

[3 marks]

Continued...

Question 4

(a) The choice of algorithm limits the choice of data structure. Suggest appropriate data structure for sequential search, binary search, selection/insertion sort, merge sort, and quick sort. There can be more than one data structure for each algorithm. [5 marks]

(b) Sort **87 73 76 68 70 76 79 87 69 82** using quicksort version 2. Use the first element as pivot. Show the loLimit, hiLimit and pivot at each step

[10 marks]

(c) Using the sorted array of numbers from part (b), show the steps needed to search for number **73** using binary search. Circle the number compared with the number **73** in each step.

[8 marks]

(d) Discuss the advantages and the disadvantages of using binary search compared to sequential search.

[2 marks]

End of Paper